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ABSTRACT

The performances of 100 4-year olds on the Matching Familiar Figures Test were analyzed in terms of decision time and decision accuracy. The subjects were divided into four groups: (1) the fast/inaccurates, (2) the slow/accurates, (3) the slow inaccurates, and (4) the fast/accurates. Assessment of individual personality characteristics showed that fast/inaccurate children, rather than being impulsive, were comparatively anxious, hypersensitive, vulnerable, and structure-seeking. Research on reflection and impulsivity is discussed as well as the general implications of the present study. (SET)

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SOME MISGIVINGS ABOUT THE MATCHING FAMILIAR FIGURES TEST AS A MEASURE OF REFLECTION-IMPULSIVITY[1]

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Abstract

In recent years the dimension of "reflection-impulsivity" (R-I), has attracted appreciable interest as an important way of conceptualizing individual differences in children. R-I has been posited as underlying decision time under conditions of response uncertainty and the Matching Familiar Figures test (MFF), a match-to-standard task, has been employed as the primary medium for operationalizing this dimension.

We suggest there is a fundamental discrepancy between the way in which R-I has been conceptualized (in terms of decision time) and the way in which it has been indexed in practice (giving large and unspecified weight to decision accuracy as well as decision time). This discrepancy permits results based upon MFF performance to be viewed in terms different from R-I.

A review of the literature finds little or no clear behavioral evidence for the R-I interpretation of MFF performance. Our own analysis of MFF performance in a sample of 100 four-year-olds, wherein the separate contributions of decision time and decision accuracy could be evaluated, indicated that decision accuracy had important personality concomitants but decision time was personologically inconsequential. Fast/Inaccurate children, when directly and independently assessed, were found to be comparatively anxious, hypersensitive, vulnerable, structure-seeking

individuals rather than being impulsive, minimally concerned and unanxious as posited by the R-I interpretation. Some general implications of our analysis and study are drawn.

SOME MISGIVINGS ABOUT THE MATCHING FAMILIAR FIGURES TEST AS A MEASURE OF REFLECTION-IMPULSIVITY

Some years ago, in an evolving series of studies, Kagan introduced an individual differences dimension he labeled as "reflection-impulsivity" (R-I) (Kagan, Rosman, Day, Albert & Phillips, 1964; Kagan, 1965a; 1965b; 1965c; 1966a; 1966b). Having first proposed the importance of differences in "analytic" and "non-analytic" attitudes (Kagan, Moss & Sigel, 1963), Kagan was led by closer empirical evaluation to conclude that R-I was one of many determinants of analytic vs. non-analytic attitudes and shifted his research to this newer and less confounded dimension.

The prototypical way of operationalizing R-I, according to Kagan, is by decision time under conditions of uncertainty. Slow deciders in uncertain situations are "reflective;" quick deciders in uncertain circumstances are "impulsive." The Matching Familiar Figures test (MFF), a matching-to-standard task involving several alternatives to create response uncertainty, was developed to stratify individuals

along this designated reflection-impulsivity continuum. The MFF test has become accepted as "the primary index" of R-I in children and by now has been employed as a criterion measure of R-I in a wide variety of investigations.

In retrospect, it seems clear that much of the reason for the appreciable research popularity enjoyed by the MFF is to be found in the great surplus meaning and implication of the terms, reflective and impulsive. Reflectivity and impulsivity are concepts widely-held and broadly-construed by many people and used in their efforts to understand personality functioning. Psychologists of various persuasions have employed these or closely related terms in their theorizing or as the conceptual basis for ordering otherwise diverse relationships (c.f., e.g., Barratt, 1959; Block & Block, 1952; Eysenck, 1957; Guilford, 1959, p. 412; Sutton-Smith & Rosenberg, 1959). Psychiatrists, social workers, educators, even lay people also use the labels, impulsive and reflective, in important and implicative ways. Although doubtless there are differences in the way the terms are used by different individuals, the core behavioral meaning of these natural-language terms seems to be clear enough so that users of these labels believe they understand each other. So, the availability of an objective and convenient way of indexing R-I, broadly

conceived, in children was immediately attractive and consequential.

Like most psychologists, Kagan construes the concepts of reflectivity and impulsivity in their broad sense, as having many behavioral implications. Although repeatedly defining R-I in highly specific and narrowing terms, operative only in situations of high response uncertainty where the child must decide among alternatives which are available simultaneously or in close temporal contiguity, Kagan also, and repeatedly, provides indications he means R-I in its ramified and generally understood sense. Thus, an impulsive child is further characterized by Kagan as being restless, distractible, hyperactive, emotionally uncontrolled, risk-taking, gregarious, hyperaggressive, and retaliative (Kagan et al., 1964, pp. 29-32; Kagan, 1965c, pp. 154-8; Kagan, 1966b, p. 124; Kagan & Kogan, 1970, p. 1315). These qualities of the impulsive child, and similarly, the qualities Kagan attributes to the reflective child, leave little doubt that Kagan is using the concept, R-I, in its larger and generally understood meaning, although he may prefer to operationalize the concept by procedures such as the MFF that are congruent with his paradigm of decision time under conditions of uncertainty.

It is a heavy responsibility for one measure (or simple variants of one measure) to be taken as the sole and sufficient criterion of impulsive and reflective behavior.

If conclusions relating R-I to social class (Kagan & Kogan, 1970, p. 1312), cultural deprivation (Kagan, 1966a, p. 24), diagnosis and educational practices (Kagan, 1965a, p. 627) are to be offered on the basis of research relationships, this consequential empiricism must be dependable and the interpretation of the criterion measure of R-I, the MFF test, must be well-founded.

Some analyses undertaken quite incidentally in the course of our own research on personality development, where we have employed the MFF procedure as a "marker" or reference measure, have led us to quite a different view of the meaning of behavior in the MFF situation. To place our findings in larger perspective, we reviewed closely the empirical literature surrounding the MFF and were surprised by the paucity, inconsistency, and irrelevance of the evidence for the construct validity of the MFF. Pressing further, in studying the theoretical rationale underlying utilization of the MFF, we noted a fundamental discrepancy between the way Kagan conceptualized R-I (in terms of response latency) and the way he subsequently elected to operationalize R-I (giving weight to response accuracy as well as response latency). This discrepancy permits empirical consequences that explain our own and other results in terms different from "impulsive" or "reflective" decision tempo.

In reporting this evaluative journey, our sequence of

progression is reversed in order to improve the logical flow of the argument: first, we describe the discrepancy between Kagan's conceptualization of R-I and his operationalization of R-I; second, we assess the construct validity of the MFF through a survey of the literature; and third, we present a representative portion of the data from our own research program that bears upon the meaning of the MFF situation.

Conceptualization Versus Operationalization

Kagan has conceptualized R-I in terms of "decision time." Thus, "the reflection-impulsivity dimension describes the child's consistent tendency to display slow or fast response times in problem situations with high response uncertainty" (Kagan, 1965c, p. 134). Further, decision times in such situations are "relatively orthogonal to traditional intelligence scores (Kagan, 1965a, p. 610), i.e., "impulsives" and "reflectives" are of equal intelligence (Kagan, 1966a, p. 17). A consequence of the tendency toward fast decision in uncertain situations is an increased likelihood of making errors because errors can be caught before a response is overtly made (Kagan, 1965c, p. 134).

According to Kagan, "the primary operational index of R-I is response latency in complex visual discrimination tasks in which a standard stimulus and a fixed set of response alternatives are presented and the response alternative that matches the standard is not immediately obvi-

PS 006 526

ous" (Kagan, 1965a, p. 609). The MFF procedure has emerged as the preferred medium for indexing the child's position on this dimension (Kagan, 1966a, p. 18).

In practice, however, response latency has not been the sole criterion for selecting "impulsive" and "reflective" children. Rather, the typical, oft-repeated operationalization introduced by Kagan identifies "impulsive" children as those below the median of MFF response time and also above the median on MFF errors; "reflective" children have been operationally defined as those above the median on response time and also below the median in number of errors. The children in the remaining two quadrants generally have not been considered further.

The conceptual rationale for using response errors as well as response time to operationalize R-I is puzzling. Response errors are only a partially correlated consequence of rapid decision; response errors per se are not a defining characteristic of R-I because such errors can arise for many, alternative reasons (e.g., low intelligence, anxiety, misunderstanding of the instructions, poor vision, and so on). The negative correlations generally found between response time and response accuracy (averaging about .4) are far from being high enough to justify, conceptually or empirically, co-ordinate status for response errors in determining, together with response latency, whether someone shall be identified as "impulsive" or "reflective."

A troublesome ramification of employing response error as well as response time in operationalizing R-I is that response error, because it is a function of a multiplicity of factors, may introduce sources of variance in subject selection that are far different and more powerful than what is indexed by response time. As a result, the basis for subject selection can "drift" from Kagan's conceptually required (and presumed) dependence on response time as the "primary operational index" to an effective dependence on response error, which is a reflection of many, variously-related and differently-interpretable components. Because subject selection via the MFF is based upon the joint or yoked criteria of response latency and response errors, it is impossible to know to what extent subsequent differences found between "impulsives" (Fast/Inaccurates) and "reflectives" (Slow/Accurates) are attributable to their differences in decision time or to their differences in accuracy. To unconfound response latency and response accuracy, it is necessary to enlarge the analysis to include those subgroups usually excluded in MFF studies, the Fast/Accurates and the Slow/Inaccurates. The first purpose of the analyses to be reported here, then, was to assess the relative influence or importance of response latency and response accuracy in understanding the psychological differences associated with MFF behavior[3].

The possibility of measure slippage, which afflicts

the MFF basis for measuring R-I, can always arise. One can help protect against it at the outset by seeking or constructing operational indicators that hew closely to the terms and implications of the concept being represented. But the most satisfying basis for confidence in a measure is to be found through construct validation -- the generation by the measure of a progressively more complex pattern of relationships that increasingly compels an interpretation in certain conceptual terms as the only means of bringing coherence to the empirical findings. Let us turn to the research literature surrounding the MFF, in order to assess its construct validity.

The Construct Validity of the MFF Test as a Measure of R-I

In Kagan's work on R-I and in studies by later investigators, the emphasis has been on using the MFF test as a measure of R-I rather than justifying it as an indicator of the broad concepts of impulsivity and reflection. As already noted, there is a danger in operationally defining a concept on the basis of a particular experimenter's intuitively reasonable interpretation of the meaning of behavior in an experimental situation. Subjects are contrary, even perverse creatures and often they will not respond to a situation along the parameters the experimenter intuitively has projected. Posited interpretations of a situation therefore must be supported by convergent and

discriminating relationships that exclude competing interpretations.

The research that has been reported using the MFF procedure can be grouped into five major categories: (1) studies of the generality of latency and error tendencies across a variety of analogous measures; (2) studies of the visual scanning strategies of children in the MFF situation; (3) intervention studies directed toward modifying the MFF performance of children earlier defined as "impulsive" or "reflective" by the MFF; (4) assessments of the effects of stress- or anxiety-inducing instructions of MFF performance; and (5) studies attempting to relate R-I as labeled by the MFF to more broadly ranging indices of impulsivity and reflectivity.

Studies of the generality of MFF responses are most numerous. Thus, MFF latencies and MFF error scores show moderate stability over time (Kagan, 1965c; Yando & Kagan, 1970). With increasing age, MFF latency increases and MFF errors decrease (Kagan, 1965c).

With respect to MFF latencies, children who are fast and error-committing in the MFF situation, when contrasted against children who are slow and make few errors on the MFF test, tend to respond more quickly in tests of inductive reasoning (Kagan, Pearson & Welch, 1966a), tend to have shorter recognition times on tasks involving tachistoscopic presentation of stimuli (Kagan, 1965b), tend to

have shorter decision times on a color-form test (Katz, 1971), and generally show shorter latencies in other tasks that involve choice among several response possibilities (Kagan et al., 1964; Ward, 1968; Odom, McIntyre & Neale, 1971). However, Shipman (1971), in a study involving more than 800 pre-school children, found little relationship between response time on the MFF and response time on the Embedded Figures Test. Eska & Black (1971) and Fancher (1970) also failed to find generalization of response latencies on an MFF procedure to other decision-making tasks. The relationship between MFF response latency and intelligence, variously measured, appears variable; the correlations reported range from -.13 (Kagan et al., 1964) to .45 (Lewis, Rausch, Goldberg & Dodd, 1968; Eska & Black, 1971) and is usually in the mid-twenties, uncorrected for attenuation.

With respect to MFF error scores, children who are error-committing and fast in the MFF situation, when contrasted against children who are accurate and slow, tend to make more errors also on tests of inductive reasoning (Kagan et al., 1966a), tend to be more error-prone in reading prose (Kagan, 1965a), and tend to have higher error scores on perceptual learning tasks (Odom et al., 1971). The relationship between MFF errors and intelligence, variously measured, appears to be quite consistent, appreciable and negative. In a number of studies, this

correlation has usually been in the negative mid-forties (Ward, 1968; Shipman, 1971; Eska & Black, 1971; and Lewis et al., 1968), uncorrected for attenuation. Indeed, Lewis et al. (1968) have concluded, on the basis of an unconfounding analysis, that MFF error scores, in girls, reflect little else than intelligence.

What conclusions can be drawn from these results? The finding that MFF latency scores have significant, if not high, correlations with other latency scores derived from analogous tasks only testifies to a generality of response latency within a rather narrow class of cognitive tasks and is not evidence, per se, for an interpretation of response latency as an index of R-I, more broadly conceived. These relationships could as well be ascribed to the pervasive influence of intellectual or motor competence or to common consequences of anxiety-based tension or to the absence of anxiety-based tension, and so on, according to the mental agility of the conceptualizer.

Similarly, demonstrations of significant, if not high, relationships between MFF error scores and other, analogously-based error scores does not have specific conceptual implication. Nor is the finding that, with increasing age, MFF latencies increase and MFF errors decrease especially supportive of an R-I interpretation. Perhaps the children being studied are simply becoming smarter, or more testwise, or less anxious, or more anxious. If MFF latency

and error scores are to be assigned interpretations in terms of impulsivity and reflectivity broadly construed, concepts with wide ramifications, then quite a different kind of evidence is required than the simple demonstration of a reliability and a generality of MFF responses.

In a second series of studies, the visual scanning strategies of Fast/Inaccurate and Slow/Accurate children in the MFF situation have been investigated in the effort to understand the perceptual-cognitive microstructure underlying R-I. Unfortunately, the relationships early reported by Siegelman (1969) and Nelson (1969) were reversed in the study by Drake (1970) whereupon subsequent studies by Zelniker, Jeffrey, Ault & Parsons (1972) and by Ault, Crawford & Jeffrey (1972) found no differences at all between F/I and S/A children in the strategies they employed in searching a stimulus complex. Ault et al. further report that, although all children seem to employ the same basic pair comparison scanning strategy in the MFF situation, accurate children, whether slow or fast, tend to be more systematic in using that strategy than inaccurate children, be they fast or slow in their accuracy. Obviously, there is nothing that can be adduced from these several studies of scanning strategies to support any theoretical position. The Ault et al. finding on degree of systematization as a function of MFF accuracy but not of MFF latency, if it proves firm, can be connected to a number of competing explanations,

excluding only the "conceptual tempo" interpretation.

A third group of studies has attempted to change the way in which children respond to the MFF. Usually, these studies have sought to influence children fast and inaccurate ("impulsive") on the MFF to become slow and accurate ("reflective"). Occasionally, studies have sought modifications in both directions. Investigators have reported that the MFF response latencies of Fast/Inaccurate children can indeed be increased by modeling procedures (Kagan et al., 1966b; Yando & Kagan, 1968; Debus, 1970; Meichenbaum, 1971) or by specific training procedures enforcing response delay, without, however, changing error scores (Schwebel, 1966; Albert, 1970; Heider, 1971). In order to produce a significant reduction in the error scores of Fast/Inaccurate children, only specific training and instruction in search strategies has proven effective (Heider, 1971; Meichenbaum, 1971; Ridberg, Parke & Hetherington, 1971; Albert, 1970; Zelniker, et al., 1972).

Certain of these studies leave much to be desired methodologically. Clarifying control or contrast groups sometimes have not been included in the research design; little attention appears to have been paid to the formidable and time-consuming problem of establishing the comparability of the alternative forms of the MFF on which these studies rely absolutely; the effects reported often appear to be highly transitory or involve unexplainable and unrep-

licated interactions; and the tabled data sometimes testify to massive and unrecognized effects of regression toward the mean. If these concerns are set aside, the results obtained suggest that children with brief response latencies on the MFF can be influenced to respond more slowly by externally-provided structuring models or by explicit instructions. If more accurate response is desired, then the child appears to require explicit provision of effective solution strategies.

But is this evidence in support of an interpretation that MFF response latencies index R-I? Conceptually, the very definition of impulsivity seems to imply that an impulsive child would be at the mercy of his impulses and therefore unable to monitor his reactions responsively to external cues and guides. Perhaps the increased latencies or the reduced errors of the modified "impulsive" children are due, instead, to their docility before the experimenter, or to their canniness as they recognize the nature of the model before them and seek approval, or due to an anxiety-attenuation and relaxation after the model or instructor displays the route to successful management of the MFF problems, or due, most simply, to having available suddenly from the experimenter new and effective problem-solving strategies. Clearly, the interpretive possibilities here are manifold; the demonstration, therefore, of the modifiability of MFF responses does not help us converge on an

interpretation of the measure as an index of R-I.

A fourth group of studies is concerned with the effects of anxiety-eliciting conditions on the MFF responses of Fast/Inaccurate and Slow/ Accurate children. In a study by Messer (1970), it was found that both Fast/Inaccurate children and Slow/Accurate children, following success on an intervening anagrams test, increased their speed of response on an MFF posttest. Following failure on an intervening anagrams task (or inferred failure in the case of control group children who assumed that retesting on the MFF must have indicated earlier poor performance), Fast/Inaccurate and Slow/Accurate children showed comparable increases in response latencies on the MFF posttest. With respect to error scores, Fast/Inaccurate children showed a highly significant decrease upon retesting while Slow/Accurate children increased their errors upon retesting, a finding duly noted by Messer as attributable to regression toward the mean.

Equivalent results were obtained by Reali & Hall (1970) who found no differences between Fast/Inaccurate and Slow/Accurate children in their responses following success or failure on an alternative measure of reflectivity developed by Kagan, et al. (1964), the Design Recall Test (DRT). After success, both groups tended to revise their expectancy standards upwards; after experiencing failure, both groups lowered their expectancy standards. Finally, Ward

(1968) analyzed individual item latencies on the MFF as a function of success or failure on the immediately preceding item and noted that Fast/Inaccurate children increased their response latencies significantly more following a failed item than did the Slow/Accurate children, suggesting a greater sensitivity in the Fast/Inaccurate children to evaluational cues.

The import of these several studies for an interpretation of the MFF test as a measure of R-I is difficult to specify. The finding that both Fast/Inaccurate and Slow/Accurate children react similarly on the MFF following success and following failure is informative about the effects of the experimental manipulation or about children generally but is not narrowing of the interpretations that can be offered of the MFF test. Fast/Inaccurate children and Slow/Accurate children must differ, in conceptually compelling ways, in their responses to success and failure if an R-I interpretation of the MFF procedure is to gain support. The only differences thus far found, those reported by Ward, appear fundamentally inconsistent with Kagan's view of the "impulsive" process (see below) and also with more general formulations of impulsivity.

A fifth group of investigations has been concerned with the generalizability of "impulsivity" or "reflectivity" as defined by the MFF test, to other tasks and situations that, for conceptual reasons, clearly should relate to the

R-I dimension, broadly construed. Thus, the Motor Inhibition Test (MIT) (Maccoby, Dowley, Hagen & Degerman, 1965) requires the subject to inhibit or prolong motor responses by drawing a line or walking a line or turning a crank as slowly as possible. As a measure of the ability to inhibit response, the MIT would be expected to relate to reflectivity as defined by the MFF test. Two studies have failed to find this expected relationship (Shipman, 1971; Nadeau, 1968). In a related investigation, Hess, Shipman, Brophy & Bear (1969) found that response latency in the Design Recall Test, a measure interpreted by Kagan et al. (1964) as an index of reflectivity, did not correlate, as expected, with the MIT. A study by Harrison & Nadelman (1972) does find a positive correlation between response latency on the MFF and time under the slow condition of the MIT. However, their results are alternatively explainable since their Fast/Inaccurate children were significantly lower on intelligence than their Slow/Accurate children and MIT performance has been shown to relate to intelligence (Maccoby et al., 1965).

In a study of the ability to delay gratification, another aspect of behavior closely related to the R-I dimension, Shipman (1971) reports no relationship between the Mischel Delay of Gratification procedure and MFF time and error scores (correlations of .01 and .00, respectively). The absence of relationship between delay of gratification

and "conceptual tempo" is also reported by Hess et al. (1969), again using response latencies in Kagan's DRT as the criterion measure of R-I.

The concept of R-I also has implication for risk-taking behavior and, again, the expected relationship between MFF performance and risk-taking failed to be found in the data reported by Shipman and her associates (1971).

Katz (1971) reports that children slow and accurate on the MFF produced more form responses -- a developmentally more mature response -- on a Color-Form test than children who were fast and inaccurate on the MFF. But this finding is equivocal evidence at best for an interpretation of the MFF in terms of R-I, particularly because Slow/Accurate children in this study were older than the Fast/Inaccurate children.

It is, of course, always possible to question particular measures in psychology. Perhaps the failure to find expected relationships between R-I as indexed by specific MFF response patterns on the one hand and, on the other, such conceptually related measures as the MIT or Mischel's Delay of Gratification procedure is to be ascribed to deficiencies in these latter measures. Let us turn then to studies relating MFF responses to independently formulated personality ratings and independently formulated clinical categorizations. From many points of view, properly obtained observation-based data can provide far more compelling evidence

than is offered by the usual narrowly-based, one-time "objective" measure which tends to be over-determined by method and situation-variance.

Nadeau (1968) had teachers rate 108 nursery school boys on twelve personality characteristics relevant to reflective and impulsive preschool children, as given by Kagan et al. (1963). The boys also were administered the MFF test. She found no relationship between Rated Impulsivity, a strong factor in her analyses, and MFF latency scores, MFF error scores, or a factor conjoining MFF latency and error scores.

A study by Weintraub (1969) compared two groups of severely disturbed boys with a group of normal boys having no known psychiatric history. An importantly modified MFF situation was employed that neither informed the subject when he was incorrect, nor required him to continue choosing alternatives until a correct response was made. "Internalizers" were slower and more accurate on the MFF than "externalizers." By equating "internalization" with "reflectivity" and "externalization" with "impulsivity," Kagan (Kagan & Kogan, 1970, p. 1315) has been able to view this result as lending support to an R-I interpretation of the MFF. Unfortunately, normal boys who theoretically would have to fall in between the "internalizers" and "externalizers" if an R-I interpretation is to apply proved instead to be even faster and more accurate than the "internalizers."

The pertinence of this study for a validation of the R-I dimension seems even further removed when it is noted that "externalizing" was defined by such symptoms as, e.g., encopresis, sexual perversions, poor school work, and fire-setting, while "internalizing" was indexed by case history indications of, e.g., phobia, insomnia, obesity and vomiting.

Ault et al. (1972), in one of the rare studies evaluating children in all four MFF quadrants, asked a classroom teacher to rate 25 of the children in her class with respect to attention, hyperactivity, and motivation. All the children had taken the MFF and were classified by median splits on latency and errors, as usual. Details of the rating procedures are not provided and from consideration of the items defining the Attention Scale (attention to class activities, attention to play-like activities, attention to group work activities, attention to individual work, constant full attention, and ability to divide attention), it may be that this score is more a measure of cooperativeness than of ability to sustain or concentrate attention. Ault et al. found that S/A children were rated significantly higher on the Attention Scale, the remaining three groups (the F/A's, the S/I's and the F/I's) all being rated at about the same level. There were no differences among the groups with respect to Motivation. With respect to Hyperactivity, the S/A children and the F/A children were rated

as significantly lower that the S/I children and the F/I children, i.e. hyperactivity characterized the children who were inaccurate in their MFF responses and was not associated with MFF response latencies. However, boys generally were judged as more hyperactive than girls and unfortunately, as Ault et al. note, sex of child proved to be heavily confounded with MFF groupings (e.g., no boys were classified as F/A's). Closer analysis therefore suggests this last finding is attributable more to the greater tendency of boys in this sample to make errors on the MFF than it is to MFF error-making, per se.

Study 8 in the monograph by Kagan et al. (1964) briefly describes three early attempts to relate motor restlessness or distractibility to R-I as indexed by the number of "analytic responses" on the Conceptual Style Test (CST) of Sigel. In one part of this study, the number of errors on the Design Recall Test was conjoined with a number of CST responses to define "impulsive" and "reflective" children. Although response time is central to Kagan's notion of "conceptual tempo," it was in no way used to index R-I. We deem these early, and largely equivocal,[4] analyses as irrelevant to the present inquiry.

Kagan's notion of reflectivity-impulsivity developed out of earlier research on "analytic" versus "non-analytic" styles of thought (Kagan et al., 1963; Kagan et al., 1964). A source of confusion has been the sometime equating by

Kagan and by others of the "analytic" attitude with "reflectivity" and the "non-analytic" attitude with "impulsivity." Conceptually and operationally, they are fundamentally different.

Kagan's analytic/non-analytic distinction refers to an individual's tendency or ability to conceptually connect objects by discerning their "similarity in an objective attribute that was a differentiated part of the total stimulus" (Kagan et al., 1964, pp. 3-4). The primary measure for operationalizing analytic and non-analytic attitudes has been the number of "analytic concepts" manifested by a subject on the CST. Kagan's R-I or "conceptual tempo" distinction centrally relates to decision time and cannot be operationalized by measures that do not involve response latency. Indeed, Kagan et al. (1964) firmly declare: "The phrase analytic attitude....shall refer specifically to analytic concepts on CST; whereas, the reflection-impulsivity variable refers to response time, when it is understood that long response times are associated with low error scores" (p. 18). Further, they view the analytic/non-analytic distinction as having "multiple antecedents," hypothesizing that R-I is only one of these antecedents (p. 32). But a partial antecedent cannot be equated with a consequent nor can a consequent be equated with one of its antecedents. The occasional operationalization, therefore, of R-I by the CST rather than by a measure of con-

ceptual tempo is logically and theoretically incorrect.

In addition to this argument of reason, it merits recording that empirical tests of the relationship between measures of analytic and non-analytic thinking and measures of "reflection-impulsivity" do not support the substitution of analytic measures for R-I measures. The correlations to be found in Kagan et al. (1964, Studies 2, 3 and 5) are low and inconsistent. Denney (1972) in a study contrasting highly analytic children with highly non-analytic (relational) children, found that analytic children were a bit faster and made more errors on the MFF than non-analytic children. The difference in the wrong direction was not significant but certainly there was no evidence for the strong relationship between analytic style and slow, accurate MFF response positied by Kagan. In our own research using the sample to be described shortly, Sigel's Object Sorting Test, a standard measure of analytic thinking was also employed along with the MFF. "Impulsive" (Fast/Inaccurates) and "reflectives" (Slow/Accurates) did not differ, nor are there suggestive trends in the number of analytic concepts these two groups offer. The point-biserial correlation between the F/I's and S/A's versus the number of analytic responses was only -.09.

In view of these arguments and findings, the study by Fisher (1966) using the number of analytic responses on the CST to measure R-I loses cogency. She found that children

judged clinically to be highly impulsive did not differ from children designated as normal, with respect to their analytic scores. She concludes that the CST analytic score is invalid but, as we have just seen, a fairer conclusion would be that the CST was irrelevant for the discrimination desired with respect to "conceptual tempo."

In a later chapter, Kagan (1965c, pp. 155-6) very briefly refers to a study then underway seeking to relate observations of children's behaviors in the home and in a nursery school or day camp to their classification as F/I's or S/A's. The preliminary analyses, as reported by Kagan, suggest that S/A children tend to have higher intellectual standards, tend to be more persistent with intellectual tasks, are less socially interactive and more physically cautious than F/I children. This study does not appear to have been formally published subsequently, so its methodological features and full results are not available.

Another study, however, was suggested by the preliminary finding that S/A children showed higher standards of performance with intellectual tasks and persisted longer with difficult tasks. As briefly described by Kagan (1965c, pp. 157-8), a 40-minute solitary play session was employed wherein the child was free to play with either hard tasks or easy tasks. S/A boys spent significantly more time with the hard tasks than did F/I boys but this difference did not obtain between S/A girls and F/I girls. Kagan explains

the absence of his expected relationship among girls as due to the greater salience of "verbal skills" in girls in determining free play performance. But he does not go on to explain his explanation. It is also disconcerting that the conclusion drawn from this study does not acknowledge the different relationships characterizing the boy and girl samples but, rather, summarizes the results as supporting the hypo thesis in regard to reflective children. This study has not been published elsewhere with the information and detail necessary to permit its evaluation. In particular, in neither of these last two studies is it possible to assess the role of IQ or intellectual competence as an alternative explanation of the findings reported.

Besides the studies described above, we have been unable to find investigations oriented toward assessing the personality qualities associated with different MFF response patterns.[5]

One does not have to be much of a skeptic to view the relationships we have summarized as impressively insufficient for an interpretation of MFF response patterns specifically in terms of impulsivity-reflectivity. The question remains: do individuals classified as "impulsive" (Fast/Inaccurates) or "reflective" (Slow/Accurates) solely by means of Kagan's rules applied to the MFF procedure behave impulsively or reflectively in everyday life and when evaluated in alternative and broader-based ways? And what are

the personality characteristics of children who are Fast/Accurates or Slow/Inaccurates? Surely, they deserve understanding as well, rather than exclusion from study -- they represent large proportions of the populations investigated. What are they like? A second purpose, then, of the analyses to be reported here was to study the personality characteristics of the children falling in the two generally unstudied quadrants. We note that this second analytical emphasis, concerning the personality correlates of various MFF response patterns, is logically separate from the first purpose of this study, unconfounding of the two jointly-applied variables, response latency and response accuracy, to assess their relative importance in generating psychological differences.

Over the years, Kagan has offered a number of conjectures regarding the psychological dynamics underlying R-I as indexed by decision-making in uncertain circumstances. Early on (Kagan et al., 1964) it was suggested that "impulsivity" and "reflectivity" might be due to: (a) constitutional variables; (b) different standards of performance (the "impulsives" being posited as having lower standards); and (c) different degrees of expectation of success, where expectation of success is presumed to create a self-confidence needed in order to withhold immediate, and likely wrong, response (the "impulsives" being posited as having lower expectations of success). Later, Kagan (1966a) sug-

gested another explanation: (d) a desire or anxiety for quick success co-exists with a desire or anxiety to avoid committing errors (the "impulsives" being posited as valuing quick success more than error avoidance and therefore manifesting rapid response).

The most recent and now most favored hypothesis regarding the basis of decision time under uncertainty drops the notion of desire for quick success and simply states: (e) "the greater the fear of making a mistake, the more reflective and cautious the performance.... Reflectives seem to be overly concerned with making a mistake and wish to avoid error at all costs. Impulsives seem minimally apprehensive about error and consequently (italics added) respond quickly" (Kagan & Kogan, 1970, p. 1314).

Prior research by Block and Petersen (1955) and by Smock (1955) on the nature and personality significance of decision time under uncertain and ambiguous circumstances presents an alternative view of the psychological processes involved. Block and Petersen found the fast decider in an uncertain situation to be a rigid, generally slow, narrow, submissive, over-controlled individual who is "rapid more because he is startled into response than because of a confident assertiveness.... When the press for decision is upon the decider, a fast decision is in a sense 'too fast' in that it represents an uneasiness with the responsibility for decision and a dependent seeking for structure" (Block

& Petersen, 1955, pp. 39-40).

Smock (1955) studied the effects of an anxiety-eliciting, success-oriented motivation on decision time and accuracy in selection from among multiple alternatives under ambiguous or uncertain conditions. He found that such stress caused subjects to respond earlier and with greater inaccuracy. He concluded that "stress results in an inability for some individuals to withhold response to a partially structured perceptual field until adequate cues are present for the most appropriate response" (Smock, 1955, p. 182).

The conceptualizations by Block & Petersen and by Smock of the psychodynamics underlying fast decision suggest that anxiety is aroused in the individual by the uncertainties present, that some response is readily available to the subject by the very definition of the situation, and that a quick response reflects an "intolerance of uncertainty" and an escape from the decision situation. Kagan's favored assumption regarding the psychodynamics of fast decision, that the fast decider lacks anxiety over the possibility of making an error and hence is not slowed in his response, is fundamentally different. A third main purpose of the present study, then, was to evaluate empirically these alternative conceptualizations; are Fast/Inaccurate children characterized by appreciable tension and anxiety, as Block & Petersen and Smock would propose,

or are Fast/Inaccurate children characterized by minimal concern and anxiety about their performance, as Kagan has suggested?

The Research Context

Subjects

Subjects were 100 children between the ages of 48 and 61 months (mean age = 55.2 months), participating in an on-going longitudinal study of ego and cognitive development being conducted in the nursery schools of the Harold E. Jones Child Study Center at the University of California. The children live in an urban setting and are heterogeneous with respect to the socio-economic and educational levels achieved by their parents and with respect to ethnicity.

The MFF Procedure

Kagan's MFF test, consisting of two practice items and 14 test items, was administered individually to each child in a familiar setting by a female examiner well known to the child. On each item, the child was shown one standard and four comparison figures and asked to select the one picture among the four comparison figures that was identical to the standard. For each item, both latency to the first response and the number of errors were recorded.

Sex differences with respect to MFF average latency and MFF average error score did not begin to approach significance (*t*-ratios of .02 and .87, respectively), and so

the boy and girl samples, combined, were classified into quadrants using Kagan's rules, i.e., median splits of the MFF latency and error distributions.[6] Thus, four groups were defined: the Fast/Inaccurates (F/I's) (N=28, 13 boys and 15 girls), the quadrant typically labeled "impulsive;" the Slow/Accurates (S/A's) (N=33, 15 boys and 18 girls), the quadrant typically labeled "reflective;" the Slow/Inaccurates (S/I's) (N=18, 11 boys and 7 girls), typically ignored in MFF research; and the Fast/Accurates (F/A's) (N=21, 11 boys and 10 girls), also typically ignored.

The Personality Data

The California Child Q set (CCQ), an age-appropriate modification of the California Q set (Block, 1961; Block, 1971), was used to develop personality characterizations of each child. The CCQ set consists of 100 widely-ranging, personality-relevant items that are ordered, using a forced-choice method, by a trained judge to express the judge's characterization of the personality of a child.

The judges employed to characterize each child were his nursery school teachers, three teachers for about half of the children and two different teachers for the other half. In judging a child, each teacher worked completely independently of the other teachers and based her personality formulation on from five to nine months of observation of the child's behavior in the nursery school setting for three hours each school day. Thus, each child was well

known by each judge and the salient, consistent qualities of each child's personality had an opportunity to become manifest. All five nursery school teachers received training and calibration in using the CCQ set before contributing their evaluations of these children. With the completion of the many Q-sorts, for each child the two or three CCQ descriptions of him independently-formulated by his teachers were averaged, resulting in one composite personality characterization which was used in subsequent analyses.

Since the implications of the analyses to be reported depend heavily on the quality (and hence, credibility) of these CCQ composites, we cite some pertinent information. For the sample of 100 children, the average reliability of these composite personality descriptions was .77. Sixty-nine of these children had been studied a year earlier as well and five entirely different nursery school teachers had at that time also formulated CCQ descriptions of each child, from which composites were generated. The average across-time correlation between these independently generated composites was .66 (43.6% of the total variance), uncorrected for attenuation. Pairings at random of CCQ composites of children at the one age level with the composites of children at the other age level results in an average across-time correlation, based solely upon chance expectation of .31 (9.6% of the total variance). Thus, of the reliable variance in the CCQ formulations, 22% (9.6%/

43.6%) is attributable to chance or to characteristics common to all children in this age range and 78% is attributable to the unique qualities of each child. It is clear, then, that reproducible and individuated characterizations of the personality qualities of the children were achieved.

The demonstration of the achievement of reliable, differentiated, independently-contributed but consensus-based personality descriptions based upon long-term observations of each child may well be sufficient evidence for many psychologists that the CCQ composites contain reasonably trustworthy information.[7] However, some additional relationships drawn from the larger study can reinforce our necessary assertion. Various experimental procedures designed to reflect particular personality dimensions were administered to these children when between three and four years of age. Certain CCQ items, rated separately by the nursery school teachers, also reflect these personality dimensions. It is instructive to evaluate the correlations between scores derived from experimental procedures and their corresponding CCQ ratings. Thus, curiosity as measured in a Curiosity Box situation (after Banta) correlates .42 with the CCQ item, "Is curious, exploring." Distractibility as measured in a situation where the child works on a task while a TV-like slide projector is screening interesting pictures in the periphery of his vision proves to correlate -.40 with the CCQ item, "Is attentive, able to

concentrate." Actometer scores, based upon self-winding watches modified to reflect the number of discrete motions of the child correlates .59 with the CCQ item, "Is active, lively." A measure of delay of gratification, based upon the number of candies a child elects to work for before stopping to taste any correlates -.41 with the CCQ item, "Is unable to delay gratification." The correlation between WPSSI Full Scale IQ and the CCQ item, "Appears to have high intellectual capacity (whether or not expressed in achievement)," is .52. Many other such correspondences between experimental or situation-based scores and their corresponding CCQ items could be cited beyond this particular sampling. Again, our purpose is to show the widely-ranging validity of the CCQ descriptions. We suggest, from the several kinds of evidence briefly summarized above, that the CCQ personality formulations of the children in our sample cannot readily be discounted as unreliable or only narrowly-based.

Having achieved reliable and individuated personality descriptions of each child, summary scores were developed from the CCQ data to index two dimensions of central importance in our larger research context but also of special relevance for this particular study as well. Three experienced clinical psychologists were asked to consider the personality implications of the concept of ego-resiliency (Block, 1965; Block & Block, 1973) which involves the

assimilative and accomodative capacities of the individual under conditions of environmental stress, uncertainty, conflict or disequilibrium. They were also asked to consider the behavioral implications of under-control (Block, 1950; Block, 1951; Block, 1965; Block & Block, 1951; Block & Block, 1952; Block & Block, 1973), the pole of the dimension of ego-control involving inability to delay gratification, impulsivity, behavioral spontaneity, short-term commitments, and other manifestations of an insufficiency of the modulation or direction of motivations.

Using the CCQ set, each psychologist was then asked to portray the personality characteristics of a hypothetical ego-resilient child and also the personality characteristics of a hypothetical under-controlling child. There was high agreement among the three psychologists, the reliability of the composite ego-resiliency portrayal being .91 while the reliability of the composite under-control description was .90.

These composite formulations can be viewed as criterion definitions. Subsequently, the actual CCQ description of each subject was correlated with each of the two criterion definitions. The resulting correlations index the similarity between the personality of the particular child, as judged by his nursery school teachers, and the criterion definitions of the two constructs. If the correlations are relatively high, that subject is relatively ego-resilient

or relatively under-controlled; if the correlations are relatively low, then the subject is relatively unresilient or relatively not under-controlled. These correlations, then, are simply scores usefully summarizing the position of each subject on the dimensions of ego-resiliency and under-control. CCQ formulations from a year earlier exist for 69 of the children in our sample and it was possible to compute entirely independent Resiliency and Under-control Index scores for this earlier period as well. The correlations across time for these two summary scores, uncorrected for attenuation, are .65 and .78 for Resiliency and Under-control, respectively, suggesting these scores reflect pervasive and continuing characterological properties. The correlation between the Resiliency and Under-control Indices was -.25.

Results

For each MFF quadrant, the group size, sex composition, intelligence test scores, and Resiliency and Under-control Index Scores are provided in Table 1.

Insert Table 1 About Here

Sixty-one percent of the children fall into the two quadrants typically analyzed in MFF research, the F/I and S/A groups; 39% fall into the quadrants typically ignored. The correlation between MFF latency and error scores is

-.33. The internal consistency reliability of MFF latency is .89; for MFF errors, .62. Based on 64 children tested one year earlier as well, the stability or across-time correlation for MFF latency is .19; for MFF error, the stability or across-time correlation is .34. As measured by WPSSI Full Scale IQ, intelligence correlated .14 with MFF latency and -.39 with MFF errors. These several figures are in reasonable accord with related figures in the literature. As intimated by the intelligence-MFF correlations, the quadrants differ significantly ($p < .01$) in IQ, the S/A's being highest and the S/I's lowest. For each quadrant, there appears to be no important difference between the Verbal and Performance parts of the WPSSI.

The Relative Influence of MFF Latency and MFF Accuracy in the Personality Domain

Our first concern was to evaluate comparatively the relationships of MFF latency and MFF accuracy to personality characteristics. The four quadrants defined by median splits on MFF response latency and MFF response errors define a 2 x 2 analysis of variance design. Using least squares ANOVA because of the unequal numbers of children in each quadrant, each of the 100 CCQ items was evaluated to assess the personality qualities associated with MFF latency, with MFF error, and with the interaction of MFF latency and MFF error.

Only two personality attributes emerge as significantly associated ($p < .05$) with MFF response latency. In con-

trast, 32 personality characteristics are significantly related beyond the .05 level to MFF errors and 18 CCQ items reach significance beyond the .05 level as a function of the interaction of latency with error. The quantitative difference (2 versus 32) in the "pull" or extent of ramification of the latency and the accuracy facets of the MFF procedure is itself highly significant ($p < .001$). The number of significant interactions is also reliably larger ($p < .001$) than the "pull" of the latency classification, alone. It appears, then, that the personality implications of MFF response latency are directly small and find expression primarily in interaction with or as a function of MFF errors. The personality implications of MFF accuracy or inaccuracy, on the other hand, are directly abundant and indirectly also of importance. If this result can be viewed as having general implications, then in studies where Fast/Inaccurates ("impulsives") have been contrasted only with Slow/Accurates ("reflectives"), the differences obtained have been largely associated with MFF error, directly or indirectly, rather than being due to the primary influences of MFF response latency, as initially posited by Kagan.

The Personality Characteristics Associated with MFF Responses

Our second concern was to study the nature of the personality qualities associated with MFF errors, MFF

latency, and their interaction. Table 2 catalogues the significantly differentiating CCQ items together with their means for the four quadrants and indications of the nature of the significant association observed.

Insert Table 2 About Here

Personality characteristics associated with MFF response latency. The two CCQ items associated with MFF response latency are: becomes strongly involved in what he (or she) does (.05) and is easily victimized by other children, tends to be treated as a scapegoat (.05). The fast children are both more engaged in their activities and more easily put upon by their peers. It would be very premature to interpret these very few findings in larger terms until replication -- they may well be a function of chance.

Personality characteristics associated with MFF response accuracy. The CCQ items associated with the MFF accuracy dimension are, in their number and nature, far more compelling of psychological interpretation. Relatively more characteristic of the accurate children are the following items:

Is considerate and thoughtful of other children (.01); uses and responds to reason (.01); is reflective, thinks and deliberates before he (or she) speaks or acts (.01); gets along well with other children (.01); develops genuine and close relationships (.01); can recoup or recover after

stressful experiences (.01); is helpful and cooperative (.05); shows concern for moral issues, e.g., reciprocity, fairness, and the welfare of others (.05); shows a recognition of the feelings of others (.05); is admired and sought out by other children (.05); is protective of others (.05); appears to have high intellectual capacity, whether or not expressed in achievement (.05); is verbally fluent, can express ideas well in language (.05); and is creative in perception, thought, work or play (.05).

The CCQ items relatively more characteristic of the inaccurate children are as follows:

Tries to take advantage of others (.01); reverts to more immature behavior when under stress (.01); characteristically pushes and tries to stretch limits, sees what he can get away with (.01); tends to go to pieces under stress, becomes rattled and disorganized (.01); is afraid of being deprived, is concerned about getting enough affection, food, toys, etc. (.01); overreacts to minor frustrations, is easily irritated or angered (.01); is easily victimized by other children, tends to be treated as a scapegoat (.01); has transient interpersonal relationships, is fickle (.05); is self-assertive (.05); is aggressive, physically or verbally (.05); tends to become rigidly repetitive or immobilized when under stress (.05); is jealous and envious of others (.05); tends to dramatize and exaggerate mishaps (.05); is unable to delay gratification, cannot wait for satisfactions (.05); appears to feel unworthy, thinks of self as "bad"

(.05); is easily offended, sensitive to ridicule or criticism (.05); tends to be suspicious and distrustful of others (.05); and tends to be sulky and whiny (.05).

A clear personality dimension seems to underlie these differences in MFF accuracy. The Accurates are identified as comparatively competent, resourceful, empathic, interpersonally attractive children -- they are more socially perceptive, brighter, more reasonable, more approachable individuals. The Inaccurates, on the other hand, appear to be relatively vulnerable, poorly defended, demanding, overly sensitive and brittle children -- they are more lacking in self confidence, more likely to feel discriminated against, tend to be more rigid, and are less happy.

The differences between the Accurates and the Inaccurates include CCQ items referencing the intellectual or cognitive realm that are consistent with the differences in WPSSI test scores shown in Table 1. Indeed, the Accurate and Inaccurate groups differ significantly in intelligence, as measured by the WPSSI ($p < .01$). However, it would be difficult to claim that intelligence, at least as it is usually and narrowly conceived, is the basic dimension underlying the differences obtained because interpersonal behaviors and also aspects of personality functioning such as reactions to stress and frustration are associated as well with Accuracy-Inaccuracy.

We view the common denominator of the personal

qualities manifested by the Accurates as an ability to negotiate environmental demands without undue anxiety. The Accurates appear to be responsive to their environmental context and capable of constructing identity-preserving accommodations to a variey of task and interpersonal demands. The Inaccurates may be characterized as more easily overwhelmed by environmental demands or complications not readily assimilated. Their accommodations to task and interpersonal situations for which established structures or modes of responding are not immediately available tend to be either rigidly stereotyped and unresponsive or grossly undifferentiated and over-responsive. As a label for this large, system-characterizing dimension of individual differences, we suggest the term, ego-resiliency. The concept has arisen in our earlier work (Block, 1965; Block & Block, 1973) and seems especially apt for describing the personality differences associated with the MFF Accuracy-Inaccuracy dimension. This interpretation is given support by the significantly higher Resiliency Index Scores achieved by the Accurates ($p < .01$), as reported in Table 1; it is given further possibility by the higher correlation the Resiliency Index achieves with MFF Accuracy (i.e. MFF errors, reversed) as compared to the correlation the WPSSI Full Scale IQ achieves with MFF Accuracy, .47 and .39, respectively.

Personality characteristics associated with the four MFF response patterns. The personal qualities of the

children in each of the four quadrants are, of course, partially indicated by the CCQ items associated with the Accuracy-Inaccuracy dimension. The presence of many significant interactions, especially those where no main effects are significant, permits additional particularization of the personality implications of the several MFF response patterns. For the most complete personality picture of each of the quadrants, it is helpful also to directly compare the S/A children with the F/I children and, separately, to compare the F/A and S/I groups.

The significant interactions, unassociated with main effects, reported in Table 2, fall into a coherent configuration that strongly differentiates the S/I children from the S/A children and also from the F/I children. Thus, the S/I children are higher than the S/A children on the following CCQ items: tries to be the center of attention; is vital, energetic, lively; likes to compete, tests and compares self to others; has a rapid personal tempo; reacts and moves quickly (N.B. brightness is not necessarily implied; only speed of response was rated); is aggressive, verbally or physically; tends to imitate and take over the characteristic manners and behaviors of those admired.

The S/I children are lower than the S/A children on the following CCQ items: is inhibited and constricted; is physically cautious; is obedient and compliant.

Before attempting to integrate the implications of

these differences, it is useful to indicate the differences observed between the S/I's and the F/I's, and between the other quadrants. The S/I children are higher than the F/I children on the following items: behaves in a sex-typed style and manner (i.e., girls behave in a "feminine" way, boys in a "masculine" way, as defined by the cultural or subcultural standard); is vital, energetic, lively; likes to compete, tests and compares self to others; is agile and well-coordinated.

The F/I children are higher than the S/I children with respect to the CCQ items: is inhibited and constricted; is physically cautious; becomes anxious when his environment is unpredictable or poorly structured; is obedient and compliant; looks to adults for help and direction.

When the S/A children are compared directly via t-test with the F/I children, only one CCQ item proves to be distinguishing beyond those already reported in the comparisons of the main effects. The F/I's are higher than the S/A's on the item: is restless and fidgety.

When the F/A's are contrasted with the S/I's, again only one CCQ item emerges as discriminating beyond those reported as main effects. The F/A's are higher than the S'I's on the item: is resourceful in initiating activities.

Our own attempt to integrate and summarize the personality characteristics associated with each of the four MFF quadrants now follows. It is based upon the complex of

findings already cited in Table 2 (including those related to the Accuracy-Inaccuracy dimension) and tries to recognize trait levels as well as trait differences in formulating the personality portrayals. The reader should understand that the interpretative descriptions offered are intended comparatively; they should not be construed as representing the absolute qualities of the children in the various quadrants.

The S/I children appear to be comparatively aggressive, competitive, unanticipating, assertive individuals, with relatively little regard for the feelings or rights of others. They have difficulty delaying gratifications and cannot abide limits. They are more egocentric than our typical child, taking advantage of others and seeking the center of the stage. They are relatively quick and uninhibited, with frustrations and conflicts being expressed directly and without modulation. The cognitive mastery of problems is not a strategem they tend to employ. This constellation of qualities clearly falls under the rubric of impulsivity, as generally defined. Appropriately, these children have the highest mean score on the Undercontrol Index.

The F/I children appear to be more anxious, more sensitive, more vulnerable, structure-seeking individuals who move toward rigidity and stereotypy when under conditions of stress. They are rather tense, are less apt to respond

to humor, are somewhat querulous, are comparatively unpopular with their peers, and tend to be viewed by adults as physically less attractive than our average child. Unlike the S/I children, the F/I's are not depicted as aggressive, competitive, assertive, exhibitionistic, uninhibited. Rather, they seem to be comparatively isolated, cautious, self-doubting children, the victims and not the perpetrators of aggression. They do not live easily in this world.

The S/A children appear to be comparatively reasonable, reflective, calm, considerate, conciliatory individuals. They are bright, hard-working, get along well with their peers, and seem interpersonally mature. Perhaps they are a bit too mature for their age since there are some indications in the S/A's of constraint, docility, and a reluctance to assert self. However, their essential competence and confidence in the world is impressive and they exemplify many traits deemed attractive in our culture. The S/A group is lowest on the Undercontrol Index.

The F/A children appear to be comparatively intelligent, popular, cheerful individuals, enthusiastic, self-confident, perhaps a bit brash and competitive. They are rational, resourceful, and vigorous in their approach to problems, they value themselves, they are independent, they are strongly engaged and unafraid of the world in which they find themselves.

Perhaps the two most directly relevant personality

characteristics for Kagan's "conceptual tempo" rationale are the CCQ items, Is reflective, thinks and deliberates before speaking or acting and Has a rapid personal tempo, reacts and moves quickly (N.B. brightness is not necessarily implied; only speed of response is to be rated). The ordering of the MFF quadrants on these two items is therefore of especial interest.

With respect to the CCQ item on reflectivity, the S/A group is highest, as Kagan would require, but the S/I group is lowest, appreciably lower than the remaining two groups. This finding, that long MFF response times are associated with both reflectivity and non-reflectivity, is incompatible with Kagan's position. With respect to the CCQ item on personal tempo, the S/A group is lowest, as Kagan would require, but the S/I group is highest, appreciably higher than the F/I group. This finding, that long MFF response latencies are associated both with slow and with fast personal tempo is also incompatible with Kagan's position.

Another way to assess the quadrants with respect to Kagan's R-I rationale is to note that, as reflected by the Under-control Index, the S/A's are least under-controlled, as Kagan would require. But contrary to Kagan's anticipation, it is the S/I's who manifest the greatest degree of under-control, appreciably more than is shown by the F/I's and F/A's who are intermediate. The difference among the four quadrants with respect to the Under-control Index are

significant well beyond the .05 level.

The Psychodynamics of Unwarranted Rapidity of Decision

The third concern of this series of analyses was to attempt closer understanding of the psychological dynamics of decision-making under conditions of uncertainty, with particular reference to the MFF. The findings already cited must be mustered again but briefly and this time addressed toward this particular focus.

The essential quadrant to understand is the F/I group for these are the individuals who display unwarranted rapidity of decision, i.e., who respond so quickly that it is clear they must have responded under conditions of uncertainty. Why did not the F/I's convert the MFF task into one where they could be far more certain, by electing to delay their decision and using the time thus gained to identify the correct stimulus? Was it because, as Kagan hypothesizes, they were minimally concerned and without anxiety about their performance? Or were the F/I's tense and anxious about the situation, as Block and Petersen and Smock found in related contexts?

The personality characteristics of the F/I's, presented in the preceding section, suggest how they perceived the decision situation and the basis on which they responded. What seems entirely clear and compelling from our findings is that the F/I's are not unconcerned and without anxiety in the MFF, as Kagan has proposed. Rather, of all four

quadrants, the F/I group is identifiable as the highest in anxious self-concern.

Our own view of the meaning of unwarranted rapid decision in the MFF situation, based upon the personality characteristics of the F/I's and their dynamic implications, follows. For convenience, this formulation is phrased declaratively, without the usual (here to be understood) qualifications.

The F/I individual is generally fearful and inhibited, with little margin of adaptability. The problem demands of the MFF and similar tasks places the F/I child in a situation where a familiar and proven response is unavailable. Anxiety results and, as a further consequence, an urgency to escape this pressuring circumstance develops. Fine discriminations, systematic scanning, non-perturbable memory are some of the accommodative qualities required for effective performance in the MFF situation, but the F/I individual lacks such composure. Unable to tolerate the continuing situation and unable to sort out or hierarchize the various facets of the complicated stimuli presented to him, he seizes upon a possible answer -- almost any answer -- because such response structures or completes the situation and permits him to move beyond it. Rather than being a sign of characterological impulsivity, unwarranted rapidity of response in the MFF appears to be a manifestation of susceptibility to anxiety. This formulation has an obvious

similarity to the understandings earlier expresed by Block and Petersen and Smock.

Discussion

Our analyses indicate:

1) The personality implications of MFF response time are slight while the personality implications of MFF accuracy are appreciable, a result in strong contradiction to Kagan's view that MFF response latency is the primary and quite sufficient basis for measuring individual differences in R-I. It follows, therefore, that in contrasting F/I's with S/A's, as has been conventional, such results as have been achieved probably were a function of the accuracy differences between the two groups rather than being a function of response tempo differences.

2) The nature of the personality correlates of MFF Accuracy, the effective component in the joint latency and accuracy basis for labeling children as "impulsive" or "reflective," simply cannot be understood in terms of R-I. The significant intellectual differences, together with their personological implications, between the Accurate and Inaccurate children perhaps provide a sufficient explanation of the relationships observed. Our own interpretive preference, based upon the wide interpersonal and characterilogical range of the findings, is to reverse this emphasis. We view the Accurates as ego-resilient individuals well-

stocked with assimilative structures but able also to accomodate to the previously unexperienced; the Inaccurates we see as comparatively brittle individuals, more rigid, less resourceful, and therefore more susceptible to anxiety. The IQ differences between the Accurates and Inaccurates would follow, we suggest, from these differences in their character structures and consequently, their cognitive styles.

3) The psychological dynamics underlying unwarranted rapidity of decisions in the MFF situation, as exemplified by the F/I's, contradicts Kagan's most recent and most favored view that little concern and minimal anxiety surrounds such response. Rather, unwarranted response rapidity seems to be a manifestation of an inability to withhold some form of response because of intensely experienced anxiety, a finding that accords well with the earlier explanations advanced by Block & Petersen and by Smock.

Obviously, replication and extension of our study is required if our positive assertions regarding the meaning of our data are to gain further and necessary support. In the meanwhile, however, we note that our conceptual and empirical criticism of the MFF as a measure of R-I stands separately, in its own right.

Why are our MFF findings so different from those found before? Perhaps because the personality data available to us for construct validation are more extensive and better

based than the personality data available, usually in an ad hoc, far from optimal way, to previous investigators. Certainly because our analytic design disentangled the MFF components, latency and accuracy, yoked together previously. But also, it is possible to discern in the MFF literature various findings construable in the present terms of ego-resiliency or intellectual competency. The lowering of the error rates of F/I's in modification studies employing training or instruction in specific strategies may be due to the ambiguity-reducing effects of the explicit structure provided to these structure-requiring and structure-seeking children. The consistent and appreciable correlations of MFF accuracy with measures of intelligence can in retrospect be viewed in the interpretive terms we prefer. Similarly, Kagan's findings that S/A's (effectively, Accurates) have higher intellectual standards and persist more with intellectual tasks than F/I's (effectively, Inaccurates) also readily fits the present explanation.

Where are we now with respect to the MFF and R-I? If our evaluation is accepted and our essential findings hold, then the MFF loses much of its attraction as a measure of impulsivity broadly conceived. The initial reason for interest in MFF decision time was the belief that response time was a way of measuring, albeit indirectly, the amount of information an individual characteristically required before coming to a decision. As we have seen, MFF response

time does not appear to possess its anticipated meaning, for reasons still obscure but likely to involve differences in basic reaction time, momentary or fortuitous sets, intellective factors, and so on. Our own suggestion is that direct quantification of the amount of information required for decision (e.g., c.f. Block, 1954) is a more useful way of measuring this cognitive variable.

If psychologists are concerned with the personality implications of MFF Accuracy-Inaccuracy, there may well be better measures of whatever it is that MFF Accuracy-Inaccuracy reflects -- such as measures of resourcefulness, intellectual competence, and so on.

If interest is directed toward the large concepts of impulsivity and reflectivity, then it appears that rather different procedures will have to be generated and validated. In this regard, our own opinion is that the constructs of impulsivity and reflectivity are too broad for any one measure to represent. To say that a concept has "surplus meaning" is also to say that an operational measure is an "insufficient indicator." Measures can and must move toward the achievement of construct validity, but such validity can never be more than incomplete. For such extensive concepts, an attractive strategem is to develop a variety of "insufficient indicators," each with its partial validity, with the expectation that a composite of these several measures will provide an appreciably superior index

of the broad concept. If one views "impulsivity" or "reflectivity" as general, pervasive characteristics of personality or cognitive style, and wishes to measure these concepts well, more than one behavior will have to be assessed.

Footnotes

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Footnotes

3. An illustration may be useful here to clarify the way in which the meaning of an index may drift if not cleanly and conceptually operationalized. Suppose we are interested in the concept of "appetite" and propose to measure daily caloric intake as a "primary index" of this concept. We further hypothesize an increased likelihood that individuals with a high daily caloric intake will weigh more than individuals with a low caloric intake. Empirically, we find the moderate correlations between daily caloric intake and weight that we anticipated. To study the wider ramifications of the appetite concept, we then operationally define individuals above the median on caloric intake and also above the median on weight as "high appetites;"

individuals below both medians are defined as "low appetites." Subsequently, we find many statistically significant differences between these two subgroups and conclude that appetite is a central, pervasive concept underlying a host of individual differences. For example, "high appetite" individuals demonstrate higher scores on the Raven Progressive Matrices Test, higher scores on the Wechsler Vocabulary subscale, and greater fertility than "low appetite" individuals.

Obviously, what has happened in this constructed but not unfair example is that by allowing weight, a somewhat correlated consequence of caloric intake to enter heavily into the operational definition of the concept of "appetite," we have opened the door for other, appetite-unrelated correlates of weight (in this instance, chronological age) to influence and even dominate the selection of individuals supposedly high and low in appetite.

4. Thus, in one sample, analytic boys displayed less respiratory variability than non-analytic boys during the first eight episodes of a sixteen-episode laboratory experiment, but greater variability during the last eight episodes. In another analysis, teachers' ratings of "emotional control" correlated .45 with analytic concepts for boys but -.20 for girls.

5. A study we cannot classify under our rubric is Kagan's effort to link R-I as measured by the MFF to body

build in children (Kagan, 1966b). He reports that in a third grade sample of boys, F/I's are more likely to be "short-broad" while S/A's are more likely to be "tall-narrow." For third grade girls, this trend was reversed, but not significantly so. In a second study using fourth- and fifth-grade children, the same trend existed for boys but was not significant; again, the findings for girls were not significant and in the reverse direction. In a third study using first-grade children, there was no association whatsoever between MFF-defined R-I and body build in boys, but tall girls tended to be reflective, contrary to the trends observed in the other two female samples. Kagan's interpretation focuses largely on the boys. He suggests that "the typical boy of age eight through ten places a strong positive value upon height and the boy who is shorter than his peers is more anxious over his strength and potency than the taller, larger boy.... This anxiety is probably chronic... (Kagan, 1966b, p. 127). ...two fundamental reactions to anxiety are retreat or retaliation. An impulsive orientation is basically retaliative. The impulsive child (sic) does not withdraw from the risks of failure, and he tends to minimize the potential danger associated with risky responses. It is possible that the extra muscle mass possessed by the short-broad boy, in contrast to the short-narrow boy, facilitates the attainment of instrumental successes that the short boy of more fragile build did

not attain" (Kagan, 1966b, p. 124).

6. A quadrant design based on median splits is far from optimal but was employed because of its conventionality in MFF research. By using quadrants, continuous score distributions are dichotomized, resulting in appreciable loss of discriminations. Further, especially with unimodal score distributions, individuals close enough to each other in the bivariate scatter-plot so as to be undistinguishable given the errors of measurement are categorized into fundamentally different quadrants (e.g., one more error, a half-second faster and a S/A is categorized as a F/I). Finally, the use of sample-dependent rather than normative or conceptual cutting points means that the categorization of a subject will depend on the particular sample in which he happens to be found. For quick, exploratory comparisons of groups, the quadrant approach is convenient, easy to understand, and often sufficiently powerful. But for the evaluation and specification of individual differences, it is far from being sensitive.

7. The reader reluctant to ascribe an intrinsic validity to the personality formulations generated as described should ponder the current repertoire of experimental procedures for assessing children and put forward a procedure for personality evaluation on which he would be more willing to place his predictive bets.

TABLE 1

Characteristics of the Four MFF Quadrants

		MFF Quadrants			
		Fast Inaccurate	Fast Accurate	Slow Inaccurate	Slow Accurate
Number of Subjects		28	21	18	33
Per Cent Male		46.4	52.4	61.1	45.5
Per Cent Female		53.6	47.6	38.9	54.5
WPPSI Full Scale IQ	$\bar{X}$	113.3	116.2	109.4	122.3
	S.D.	10.3	11.4	11.6	11.6
Under-control Index Score	X	.11	.12	.23	-.04
	S.D.	.30	.25	.32	.29
Resiliency Index Score	X	.30	.48	.29	.50
	S.D.	.35	.24	.32	.27

Table 2

CCQ Items Differentiating the Four MFF Quadrants

CCQ Item	Means of the Four MFF Groups				Significance of F-Tests		
	FI's	FA's	SI's	SA's	Response Latency	Response Accuracy	Interaction
Considerate, thoughtful of other children[a]	4.99[b]	5.22	4.29	(6.09)		.01	.05
Gets along well with other children	5.62	6.57	5.68	(6.89)		.01	
Admired and sought out by other children	4.74	5.44	4.82	(5.64)		.05	
Helpful and cooperative	5.82	5.90	4.99	(6.55)		.05	
Develops genuine and close relationships	6.09	6.62	5.21	(6.76)		.01	
Has transient relationships, is fickle	2.86	2.84	(3.49)	2.32		.05	.05
Regresses under stress	5.76	4.58	(5.94)	4.75		.01	
Tries to stretch limits	4.96	4.12	(5.10)	3.04		.01	
Concerned with reciprocity, fairness	3.83	3.95	3.41	(4.80)		.05	.05
Behaves in a sex-typed manner	6.02	6.90	(7.15)	6.60			.01
Tries to take advantage of others	3.86	3.86	(5.25)	2.96		.01	.01
Tries to be center of attention	4.40	4.78	(5.43)	3.64			.05
Uses and responds to reason	5.82	6.24	5.33	(7.17)		.01	
Vital, energetic, lively	6.26	7.03	(7.32)	6.17			.05

CCQ Items	Means of the Four MFF Groups				Significance of F-Tests		
	FI's	FA's	SI's	SA's	Response Latency	Response Accuracy	Interaction
Protective of others	4.02	4.22	3.54	(4.66)		.05	
Empathic, recognizes other's feelings	4.60	4.63	3.80	(5.50)		.05	.05
Inhibited and constricted	(4.25)	3.62	3.16	4.18			.05
Likes to compete, tests self vs. others	4.68	5.19	(5.82)	4.26			.01
Rigidifies under stress	(4.73)	3.74	4.06	3.62		.05	
Can recoup or recover after stress	5.18	(6.23)	4.98	6.16		.001	
Becomes rattled, disorganized under stress	(4.48)	3.27	4.39	3.40		.01	
Agile and well-coordinated	5.42	6.42	(6.64)	5.92			.05
Physically cautious	(4.66)	3.44	3.45	4.58			.01
Afraid of being deprived	(5.11)	3.51	4.81	3.63		.001	
Jealous and envious of others	(4.52)	3.94	4.73	3.53		.05	
Tends to dramatize, exaggerate mishaps	4.14	3.43	(4.67)	3.34		.01	
Becomes anxious in unstructured situations	(5.01)	3.86	3.68	4.31			.01
Obedient and compliant	5.28	4.78	4.27	(5.53)			.05
Rapid personal tempo, moves and reacts quickly	5.51	6.02	(6.31)	4.89			.05

CCO Items	Means of the Four MFF Groups				Significance of F-Tests		
	FI's	FA's	SI's	SA's	Response Latency	Response Accuracy	Interaction
Unable to delay gratification	5.08	4.46	(5.19)	3.76		.01	
Appears to have high intellectual capacity	6.04	6.73	6.13	(7.08)		.05	
Verbally fluent	5.75	6.70	5.57	(6.83)		.05	
Looks to adults for help and direction	(6.43)	5.22	5.41	5.79			.05
Becomes strongly involved in activities	7.43	(7.97)	6.92	7.21	.05		
Appears to feel unworthy, "bad"	(2.92)	1.94	2.68	2.33		.05	
Easily offended, sensitive to criticism	(5.52)	4.51	4.93	4.31		.05	
Tends to be suspicious and distrustful	3.57	2.98	(3.94)	2.81		.05	
Self-assertive	6.33	6.29	(6.93)	5.43		.05	
Aggressive physically or verbally	5.06	4.82	(6.12)	3.83		.05	.05
Imitates behavior of those admired	5.44	5.68	(6.04)	4.97			.05
Tends to be sulky or whiny	(4.58)	3.15	4.13	3.49		.05	
Overreacts to minor frustrations	4.94	3.79	(5.29)	3.51		.001	
Creative in perception, thought, work, or play	5.69	6.20	5.82	(6.37)		.05	

CCQ Items	Means of the Four MFF Groups				Significance of F-Tests		
	FI's	FA's	SI's	SA's	Response Latency	Response Accuracy	Inter-action
Reflective, thinks and deliberates before acting	4.80	5.15	*4.23*	(6.14)		.01	
Easily victimized or scapegoated by children	(3.66)	2.51	2.71	*2.16*	.05	.01	

a. Q-sort items are presented in abbreviated form.

b. A nine step Q-sort distribution was used: 9 indicates items most characteristic; 1 indicates items least characteristic. Bold face entries designate the group with the highest mean; italicized entries designate the groups with the lowest mean.

Printer: Set underlined numbers in italics

Set bracketed numbers in bold face type

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